

POSTER PRESENTATION

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Assessing performance of directed functional connectivity measures in the presence of common source

Jisung Wang, Heonsoo Lee*, Seunghwan Kim

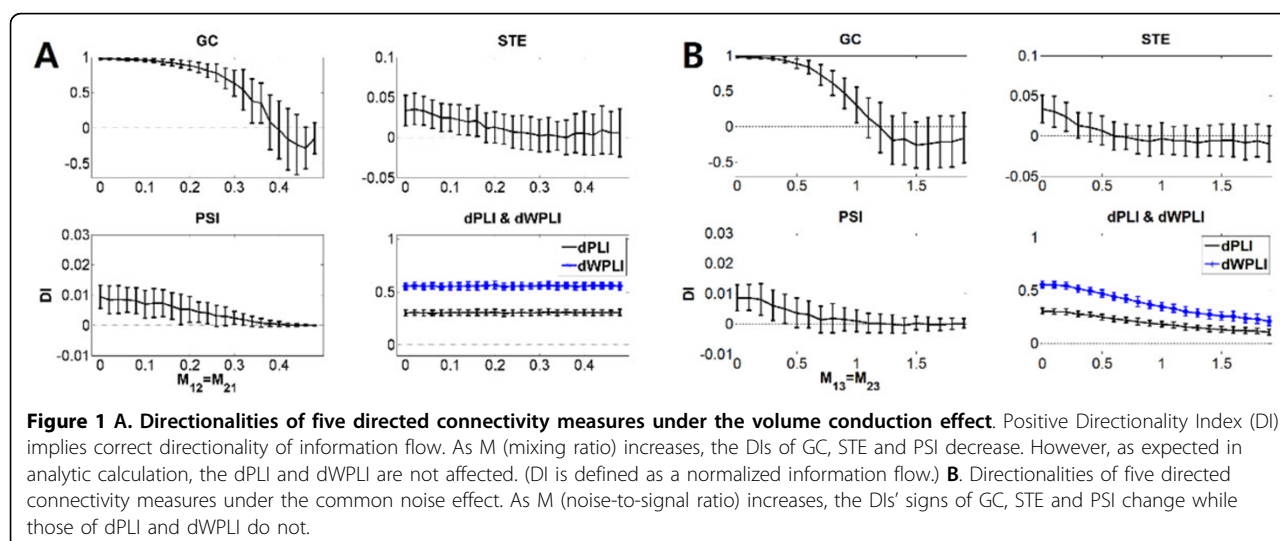
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The mixing problem of electroencephalography (EEG) in the presence of common source could affect directed functional connectivity measures, resulting in an incorrect directionality of information flow between two signals. Here we introduce directed Weighted Phase Lag Index (dWPLI), a signed version of Weighted Phase Lag Index (WPLI) and compare this measure to Granger Causality (GC), Symbolic Transfer Entropy (STE), Phase Slope Index (PSI), and directed Phase Lag Index (dPLI) under common source effects. Robustness of the measures was tested in both analytic and simulating ways.

For the simulated time series, signals were generated from unidirectionally coupled autoregressive model and linearly mixed to achieve volume conduction and common noise effects.

As expected from the analytic calculation, dPLI and dWPLI were unaffected by the volume conduction while PSI, GC and STE were largely affected. (Figure 1A). The mean percentages of false identification were 14.00 ± 7.66 , 22.35 ± 4.78 , 27.38 ± 7.04 , 1.99 ± 1.36 , and 1.63 ± 1.28 , for the GC, STE, PSI, dPLI, and dWPLI, respectively.

For the common noise case, only dPLI and dWPLI had their signs preserved. (Figure 1B). The mean percentages



* Correspondence: beafool@postech.ac.kr
Physics Department, Pohang University of Science and Technology, Pohang,
South Korea

of false identification were 30.14 ± 16.86 , 49.74 ± 16.63 , 34.72 ± 10.23 , 2.68 ± 1.90 , and 2.34 ± 1.55 .

Furthermore, the dWPLI outperformed dPLI for the common noise case ($p < 0.01$, Wilcoxon signed-rank test) which was also predicted from analytic calculation.

Present study shows the common source effects might lead to biased results with incorrect directionality of information flow. Among the five directed functional connectivity measures, dWPLI is much less affected by common source effects.

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